Carbon dioxide

Synonyms: Carbonic acid gas, Carbonic anhydride, Carbon (IV) oxide; Dry ice (in solid state).

Chemical formula		CO_2
Molar weight		44
Relative gas density (to air)		1.52
Conversion		1 ppm = 1.80 mg/m^3
Boiling point		Sublimes
Flammability		Nonflammable
Odour		Odourless
Hazards		Dusts of various metals (Mg, Zr, Ti, Al, Cr, Mn) are ignitable and explosive when suspended in carbon dioxide. In concentrations up to 1% (10 000 ppm), it will make some people feel drowsy and give the lungs a stuffy feeling. Concentrations of 7% to 10% (70 000 to 100 000 ppm) may cause suffocation, even in the presence of sufficient oxygen, manifesting as dizziness, headache, visual and hearing dysfunction, and unconsciousness within a few minutes to an hour.
Exposure limits (Directive 2006/15/EC)	TWA	9000 mg/m^3 /5000 ppm
	STEL	Not specified

Conversion of ppm to mg/m^3 is calculated for 25°C and 1 atm.

Indoor air quality in nonresidential buildings

CO2 level	Description
< 450 ppm	High quality (fresh air)
450-600 ppm	Medium quality
600-1000 ppm	Moderate quality
> 1000 ppm	Low quality

Installation guidelines

(See **Installation and connections** section for general information.)
Since CO_2 is heavier than air, it is recommended to locate the sensor not higher, than the potential leakage. For air quality control place the sensor in the breathing zone.

Calibration

E2618-CO2 series transmitters have been calibrated by Manufacturer with standard gas mixtures before delivery. Provided that the sensor is used under moderate conditions, field recalibration is recommended every 5 years. Please contact your dealer for more information.

Maintenance

Do not perform any maintenance operation with the power on.
Clean the device with soft damp cloth. Do not use any abrasive cleaning agents. Do not immerse the device into water or any cleaning media.

Delivery set

–Transmitter E2618 (wall mount or duct mount version)
– Mounting accessories:
- 4 screws with plastic dowels for wall mount version
- rubber flange for duct mount version.
- fixing clamp for remote probe version

Specifications

Sensor type	optical (NDIR)
Sampling method	diffusion
Detection range	0...10 000 ppm
Resolution / digital unit	1 ppm
Accuracy	± (50 ppm + 3% of reading) in the range 300...5000 ppm
Response time T90	ca. 2 minutes
Signal update	every 1 second
Sensor lifetime	ca. 10 years
Calibration interval	up to 5 years
Power supply options	11...30 VDC or 24 VAC
Power consumption	< 2 VA
Analog outputs	2 × 4-20 mA / 0-10 V, user settable
Outputs assignment	OUT1 2 gas; OUT2 2 gas **NOTE** for LCD version only output 1 is available
Outputs scale	0-10 000
Digital interface	RS485, Modbus RTU protocol no galvanic isolation
Load resistance	R_L < (Us - 2 V) / 22 mA for 4-20 mA R_L > 250 kOhm for 0-10 V mode:
Cable connections	screwless spring loaded terminals
Enclosure	grey ABS, wall or duct mount, protection class IP65
Dimensions	H82 × W80 × D55 mm
Operating conditions	0...+50 °C, 0...85 %RH; atmospheric pressure ±10%* non ATEXrated areas, non-aggressive atmosphere
*Ambient pressure compensation option	in the range 0,5...2 bar of absolute pressure
CE marking	according to 2014/30/EU and EN61326-1 requirements
LCD indicator option	
Operating temperature	0...+50 °C
Display dimensions	72 × 36 mm
Number of digits	3.5 7-segment
Character height	14 mm
Other features	Backlight

Warranty

This product is warranted to be free from defects in material and workmanship for a period of one year from the date of original sale. During this warranty period Manufacturer will, at its option, either repair or replace product that proves to be defective. This warranty is void if the product has been operated in conditions outside ranges specified by Manufacturer or damaged by customer error or negligence or if there has been an unauthorised modification.

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PluraSens®

Carbon Dioxide Transmitter
E2618-CO2-10K

User Manual

Evikon

E2618 series transmitters belong to the PluraSens® family of multifunctional measurement instruments. The instruments utilise gas sensors of various types with excellent repeatability, stability and long lifetime

E2618 series provides two independent analog outputs OUT1 and OUT2, user-selectable to 4-20 mA or 0-10 V, proportional either to gas concentration or temperature. RS485 Modbus RTU digital communication interface allows easy instrument configuration and integration into various automation systems.

A design with LCD indicator is available as an option.

The version of your transmitter is marked on the package.

If symbol ⚠ is marked on the equipment, consult the documentation for further information.

Safety requirements

Misuse will impair the protection of the equipment.

- Always adhere to the safety provisions applicable in the country of use.
- Do not perform any maintenance operation with the power on. Do not let water or foreign objects inside the device.
- External circuits connected to the equipment should have sufficient insulation rating according to the environmental conditions and equipment power
- A disconnecting device that is marked as such and easily accessible should be included in the installation of this product.

Operating conditions

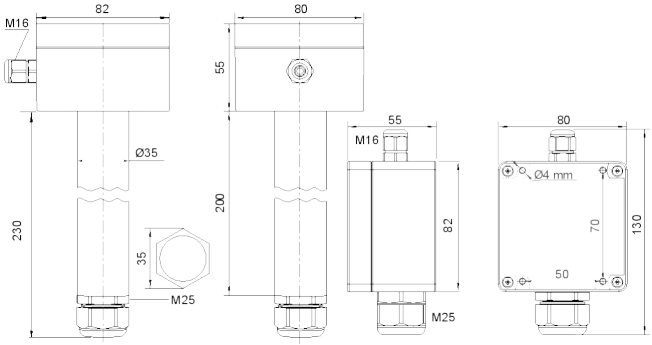
The device should be used in explosion-safe indoor areas, without aggressive gases in the atmosphere. See **Specification** table for more details.

Installation and connections

Before proceeding with the installation it is mandatory to read carefully the **Safety requirements** section and make sure to comply with all listed instructions. During the installation of the detector the following points must be considered:

- application (air quality control or leakage detection),
- properties of the space under investigation (room geometry, direction and velocity of air flows etc),
- detected gas (relative density to air, temperature, whether the gas is flammable, or toxic, or oxygen displacing),
- avoid strong vibrations, mechanical shock, and the sources of strong electromagnetic interference,
- the device should be accessible for maintenance and repair.

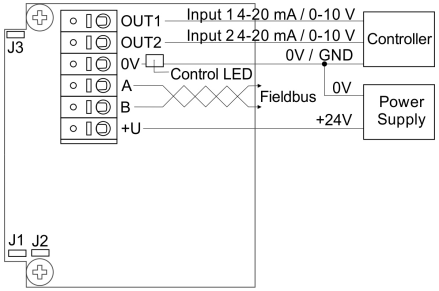
For early leakage detection install the sensor as close as possible to the potential leakage sources (flanges, valves, pressure reducers, pumps, etc), taking into consideration other points listed above. For general area monitoring without definite leakage sources, the detectors should be distributed evenly in the room. For personal safety control the detectors are installed in the breathing zone (at the height of the head of people or animals). Recommended sensor position is vertical, pointing downwards.



See **Installation guidelines** section on the next page for more information.

1. Wall mount version: Unscrew four lid screws and detach the lid from the transmitter. Attach the device to a wall with screws passing through mounting holes (for dimensions see the antecedent drawing). Duct mount version: Cut hole with a diameter of 36...45 mm in the air duct at the chosen mounting place. Place the rubber flange aligning the holes in the flange and the air-duct and fix the flange with four self-tapping screws. Pass the sensor probe through the flange and adjust it to the appropriate depth. Unscrew four lid screws and detach the lid from the transmitter.

2. Use M16 cable gland to let in cables of the power supply and of the external devices. Attach the power cable to the device without turning it on. Using the connection diagram below, connect the analog outputs and digital interface terminals to the relevant devices according to your tasks.



J1: OUT1 type (open: 4-20 mA; closed: 0-10 V)
J2: OUT2 type (open: 4-20 mA; closed: 0-10 V)
J3: return to factory settings

The screwless quick connect spring terminals on the E2618 series devices are suitable for a wide range of wires with cross-section 0,2...1,5 mm^2. We recommend to strip the wire end by 8...9 mm and to use the wire end sleeves.

To connect the wire, insert the wire end into terminal hole. To disconnect, push the spring loaded terminal lever, pull the wire out, and release the lever.

Use twisted pair cable, e.g. LiYY TP 2×2×0,5 mm^2 or CAT 5, to connect the device to RS485 network. Use one pair for A and B wires and the second pair for common 0 V and power +U wires to connect the transmitter to Fieldbus network. Respect polarity. Overall length of all connections via RS485 interface should not exceed 1200 m. The type of each analog output can be independently changed between 4-20 mA and 0-10 V with jumpers J1 (OUT1) and J2 (OUT2).

With closed jumper the output is 0-10 V, with open jumper the output is 4-20 mA. Power restart is required after changing the position of the jumpers.

The output assignments and scales can be changed by Modbus commands (see Annex 1 for more information).

By default both outputs OUT1 and OUT2 are assigned to gas concentration. The device has built-in temperature sensor which may be tied to any of the outputs.

NOTE The built-in temperature sensor is intended for temperature compensation. E2618 series devices are not meant for ambient air temperature measurement.

We recommend to set the difference between the upper and bottom limits of the output scale not narrower than 20% of detection range (for CO detectors the scales down to 5% of range are allowed). In any case, do not set the output scale below the tenfold resolution of the device.

NOTE If you use a version with LCD, only OUT1 is available.

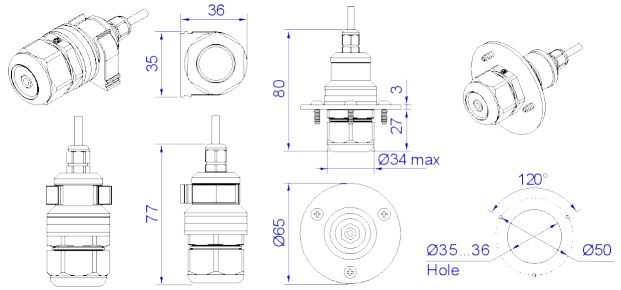
3. Turn on the power. The sensor heating up takes ca. 60 seconds after switching on. During this period analog outputs and Modbus interface are off. The operating status is indicated by the LED on the PCB of the device. The LED response to different processes is presented in the following table .

Process	LED mode
Sensor absence or malfunction	Blinking 0.5 Hz (90% off, 10% on)
Modbus response	The signal is modulated with short on-off pulses, even single Modbus cycle is traceable*
Normal operating	Continuous light

4. Make sure that the transmitter is properly mounted, the external devices connected, power on and control LED is constantly lit. Place the lid back and fix it with the screws. The device is ready to use.

Sensor probe handling

The wall mount version of the transmitter is available with remote probe (see drawing below for dimensions). The remote probe is connected to the main unit with shielded cable. Default connection cable length is 3 m



The sensor probes of all types are equipped with a hydrophobic microporous PTFE filter to protect the sensor from dust, dirt and water drops. The filter may be replaced if it gets strongly contaminated. To replace the PTFE filter, unscrew the M25 nut and remove the old filter. Place a new filter into the nut and tighten it again.

NOTE Never stab or press the filter near its centre where the sensor is located since this may damage the sensor.

The recommended orientation of sensor probe is vertical with the sensor tip pointing downwards. This prevents possible accumulation of condensed water on the sensor protection filter. The horizontal orientation is also suitable. Avoid upward position of the sensor tip.

Configuring

Gas transmitters E2618 share all functionalities of the PluraSens® multifunctional transmitter platform. The features and options include:

- digital output change rate limiting filter
- digital integrating (averaging) filter
- temperature measurement channel with internal sensor
- free assignment of each analog output to chosen parameter
- flexible setting of analog output scales for each output
- output shift and slope adjustment for calibration

A standard configuration kit includes a USB-RS485 converter and a software pack. Please contact your Seller for more information.

Return to default settings

To reset the device's Slave ID, baudrate and sbit number to factory settings, proceed as follows:

1. De-energize the device
2. Connect the J3 jumper
3. Turn on the device
4. De-energize the device
5. Disconnect the J3 jumper
6. Turn on the device

RS485 communication interface

See Annex 1

E2618_UM_EN Annex 1. Modbus RTU Communication Reference

RS485 communication interface

Databits: 8 Parity: none / odd / even Stop bits: 1 or 2 Protocol: Modbus RTU	Supported Modbus functions: 03 – read multiple registers 06 – write single register

Communication parameters

Parameter	Permitted values	Default
Supported baudrates	1200, 2400, 4800, 9600, 19200, 38400, 57600	9600
Data bits	8	8
Parity	none / odd / even	none
Stop bits	1, 2	1
Protocol	Modbus RTU	
Modbus functions	03 - read multiple registers 06 - write single register	
Error codes	01 – illegal function 02 – illegal data address 03 – illegal data value 04 – slave device failure (details of last error 04 can be read from register 0x0008)	

Modbus holding registers

Register addresses are shown 0-based, Addr in hexadecimal, Reg in decimal format.
Modbus holding register numbers MHR are shown in decimal 1-based format, and may be addressed either from 00001 or 40001 base.

Addr	Reg / MHR	RW	Description	Supported values (dec)	Default
0x0001	1 / 40002	R	Hardware version		-
0x0002	2 / 40003	R	Software version		-
0x0003	3 / 40004	R	Product serial number	1...65535	-
0x0004	4 / 40005	RW	Slave ID (net address) *	1...247 **	1
0x0005	5 / 40006	RW	Baudrate *	1200, 2400, 4800, 9600, 19200, 38400, 57600	9600
0x0006	6 / 40007	RW	Response delay, ms	1...255	10
0x0007	7 / 40008	RW	Stop bits, parity bit *	1 – no parity bit, 1 stop bit (default after factory reset) 2 – no parity bit, 2 stop bits 3 – odd parity, 1 stop bit 4 – even parity, 1 stop bit **NOTE**: 3 and 4 are available starting from the Software version 0x218 (dec. 536)	1
0x0008	8 /40009	R	Last error code	1...255	-
0x0011	17 / 40018	RW	Technological: age of data in seconds (read) / restart(write)	0...65535 s (read), 42330(write) writing 42330 restarts the device, response on Modbus will follow,1.5 seconds should be waited for restart to be completed in every case	-

* – The new value is applied after restart.
** – Broadcast slave ID 0 can be used to assign a new ID to device with unknown ID. When addressing by ID 0 the device shall be the only Modbus instrument in the network. The device will not respond to Master command when addressed by ID 0.
*** – This value is dynamic and not kept in EEPROM after restart

E2618_UM_EN Annex 1. E2618 series Modbus holding registers (part 2)

Register addresses are shown 0-based, Addr in hexadecimal, Reg in decimal format.
Modbus holding register numbers MHR are shown in decimal 1-based format, and may be addressed either from 00001 or 40001 base.

Addr	Reg / MHR	RW	Description	Supported values (dec)	Default
0x00A2	162 / 40163	RW	Zero adjustment for temperature data, °C × 100	-32000...+32000 (-320,00...+320,00 °C)	0
0x00A5	165 / 40166	RW	Zero adjustment for gas data, ADC	-32000...+32000 ADC units	0
0x00A6	166 / 40167	RW	Slope adjustment for gas data	1...65535	512
0x00A7	167 / 40168	RW	Change rate limit for gas data, ppm (‰ for O_2) / s	1...32000, 0 - no limit	0
0x00A8	168 / 40169	RW	Integrating filter time constant, s	1...32000 (seconds), 0 - no filter	0
0x00C9	201 / 40202	RW	Parameter tied to analog output 1	0 – none 1 – temperature 2 – gas concentration 9 – forced Modbus control, value set in MHR / 40204	2
0x00CA	202 / 40203	RW	Parameter tied to analog output 2	0 – none 1 – temperature 2 – gas concentration 9 – forced Modbus control, value set in MHR / 40205	
0x00CB	203 / 40204	RW	Forced value for analog output 1***	0...1000 (0,0%...100,0% of output scale)	0
0x00CC	204 / 40205	RW	Forced value for analog output 2***	0...1000 (0,0%...100,0% of output scale)	0
0x00FF	255 / 40256	RW	Sensor, analog outputs, LED and buzzer status	bit[0]=0/1 – sensor present/absent, **read-only!** bit[1]=0/1 – analog outputs deactivated/activated bit[2]=0/1 – in case the sensor is absent, turn signaling off/on analog output1 bit[3]=0/1 – in case the sensor is absent, turn on signaling with low current/high current on analog output1; if bit[2]==0 this bit will be ignored bit[4]=0/1 – in case of sensor absent, turn signaling off/on analog output2 bit[5]=0/1 – in case of sensor absent, turn on signaling with low current/high current on analog output2; if bit[4]==0 this bit will be ignored bit[6]=0/1 – current/voltage output detected on output1, **read-only!** bit[7]=0/1 – current/voltage output detected on output2, **read-only!** bit[8]=0/1 – LED deactivated/activated bit[9]=0/1 – buzzer deactivated/activated (always 0 for E2618)	-
0x0100	256 / 40257	R	Raw temperature data, °C×100	signed integer, -4000...+8500 (-40,00...+85,00 °C)	
0x0101	257 / 40258	R	Raw gas sensor data	ADC data 0...4095	
0x0102	258 / 40259	R	Measured temperature, °C×100	signed integer, -4000...+12500 (-40,00...+125,00 °C)	
0x0103	259 / 40260	R	Gas concentration, gas units	0...65535, gas units	
0x0105	261 / 40262	RW	0% value for analog output 1	signed integer, -32000...+32000 (ppm / ‰)	0
0x0106	262 / 40263	RW	100% value for analog output 1	signed integer, -32000...+32000 (ppm / ‰)	1000
0x0107	263 / 40264	RW	0% value for analog output 2	signed integer, -32000...+32000 (ppm / ‰)	0
0x0108	264 / 40265	RW	100% value for analog output 2	signed integer, -32000...+32000 (ppm / ‰)	1000

NOTE 1 Sensor absense signalling (bits from [2] to [5]) is available only for sensors with digital interface (e.g.-CO2 10K, -O2-L).

NOTE 2 We recommend to set the difference between the upper and bottom limits of the output scale not narrower than 20% of detection range (for CO detectors the scales down to 5% of range are allowed). In any case, do not set the output scale below the tenfold resolution of the device.

* – The new value is applied after restart.
** – Broadcast slave ID 0 can be used to assign a new ID to device with unknown ID. When addressing by ID 0 the device shall be the only Modbus instrument in the network. The device will not respond to Master command when addressed by ID 0.
*** – This value is dynamic and not kept in EEPROM after restart